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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,729	11/19/2003	Jozef Brcka	TAZ-240	6314

37694 7590 05/15/2007
WOOD, HERRON & EVANS, LLP (TOKYO ELECTRON)
2700 CAREW TOWER
441 VINE STREET
CINCINNATI, OH 45202

EXAMINER	
DHINGRA, RAKESH KUMAR	

ART UNIT	PAPER NUMBER
1763	

NOTIFICATION DATE	DELIVERY MODE
05/15/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dgoodman@whepatent.com
usptodock@whepatent.com

Office Action Summary	Application No. 10/716,729	Applicant(s) BRCKA, JOZEF	
	Examiner Rakesh K. Dhingra	Art Unit 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _03_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _15 February 2007_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1,3-18,20 and 26_ is/are pending in the application.

4a) Of the above claim(s) _15-18 and 20_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1,3-14 and 26_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

On further consideration and following the amendments of claims as per amendment dated 2/15/07, restriction of species as indicated below is deemed necessary. This application contains claims directed to the following patentably distinct species:

Species 1 – As per Figure 1 (Claims 1-14, 26)

Species 2 – As per Figure 7 (Claims 15-8, 20)

The species are independent or distinct because:

Species 1 – pertains to an ICP source comprising a peripheral ionization source that includes an inductive element and a slotted shield between the inductive element and the plasma.

Species 2 – pertains to an ICP source comprising a peripheral ionization source with segmented configuration and includes a shield with segmented configuration.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, at least claim 1 appears to be generic to species 1.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

During a telephone conversation with Joseph R. Jordan on 5/3/07 a provisional election was made without traverse to prosecute the invention of species 1, claims (1-14, 26). Affirmation of this election

must be made by applicant in replying to this Office action. Claims 15-18, 20 are withdrawn from further consideration by the examiner under 37 CFR 1.142(b), as being drawn to a non-elected invention.

Specification

The disclosure was objected to because of the following informalities:

Paragraph 0055, line 13 – "shield 54" may be replaced with "shield 53" as shown in Figure 7.

Appropriate correction is required.

Response to Arguments

Applicant's arguments with respect to claims 1-20 have been considered and the response is given hereunder.

Applicant has amended independent claim 1 by adding new limitations – "including at least one inductive element that generates an RF magnetic field into a plasma, connected to and surrounding the substrate support on the periphery of the substrate" and "a slotted Faraday shield between the inductive element and the plasma for facilitating the inductive coupling of energy from the inductive element into the plasma and for limiting the capacitive coupling of energy from the inductive element to the plasma". Further, applicant has also added new claim 26.

Accordingly claims 1, 3-14 and 26 are presently active.

New reference by Khater et al (US Patent No. 6,459,066) when combined with Tanaka et al and Usai reads on limitations of amended claim 1 and new claim 26. Accordingly claims 1, 26 have been rejected over Tanaka et al in view of Usai and Khater et al under 35 USC 103 (a) as explained. Further, dependent claims 3-14 have been rejected under 35 USC 103 (a) as explained below. Further, claim 1 has also been rejected under 35 USC 103 (a) over Moslehi in view of Usai and Khater as explained below.

1) In response to applicant's argument that Tanaka and Usai reference can not be combined since Tanaka is a deposition apparatus and Usai is an etching apparatus and therefore these work at different

pressures, examiner responds that Tanaka teaches limitations of the claim pertaining to location of peripheral ionization source 20, its disposition with respect to substrate support 7. Usai reference is used since Tanaka does not teach series RF circuit comprising substrate support and the peripheral ionization source, which is taught by Usai. Tanaka and Usai both pertain to plasma processing systems and it would have been obvious to one of ordinary skills in the art to combine teaching of Usai with Tanaka to generate both inductive and capacitive plasma and thus obtain uniform and high density plasma across the wafer surface as per claim limitations.

2) In response to applicant's argument that Tanaka has an internal inductive coil and Usai has an external inductive coupling coil and those skilled in the art would find it incompatible to combine these teachings, examiner responds that as indicated above, Usai reference is used since Tanaka does not teach series RF circuit comprising substrate support and the peripheral ionization source, which is taught by Usai. Further, using inductive coupling coils inside or outside the chamber interchangeably in the plasma processing systems are known in the art. Tanaka and Usai both pertain to plasma processing systems and it would have been obvious to one of ordinary skills in the art to combine teaching of Usai with Tanaka to generate both inductive and capacitive plasma and thus obtain uniform and high density plasma across the wafer surface as per claim limitations.

As regards double patenting rejection, in view of withdrawal of claims 15-18, 20 due to election of species 1 by the applicant, the double patenting rejection of claims 1, 15-20 has been withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention

was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 8, 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moslehi et al (US Patent No. 6,471,830) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066).

Regarding Claims 1, 3, 8: Moslehi et al teach an ICP source for plasma processing apparatus (Figure 4) comprising:

an RF generator 126;

a coil segment 116 (peripheral ionization source), that generates an RF magnetic field into a plasma, and surrounding the substrate support on the periphery of the substrate support, the substrate support and the peripheral ionization source forming a common planar surface having a substrate support surface at its center (since heights of coil segment 116 and chuck 140 are adjustable relative to each other;

a matching network 128 coupling the RF generator into the coil segment 116 (peripheral ionization source); the RF generator coupling RF energy to energize the peripheral ionization source 116 to inductively couple to the plasma proximate the planar surface, thereby forming a high density plasma across the planar surface by inductively coupling;

Moslehi et al also teach a slotted shield 176 (Figure 16) between peripheral ionization source 172 and plasma.

Moslehi et al teach RF circuit that includes peripheral ionization source 116 but do not teach that the circuit is aseries circuit and also includes substrate support that is biased by RF source and the peripheral ionization source is connected to substrate support. Further, Moslehi et al also do not teach that shield is a Faraday shield.

Usai teaches a plasma apparatus (Figures 1-4) that comprises an RF generator 6,

a series RF circuit that includes a substrate support electrode 3 and an inductive plasma coil (peripheral ionization source) 2, {that is, peripheral ionization source and the substrate support are connected together) a matching circuit 5 coupled to the series circuit such that both capacitive and inductive plasma are generated within the vacuum chamber. Usai also teaches that the apparatus generates a stable high density plasma (Column 3, line 30 to Column 4, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use an RF series circuit that also includes the substrate support which is biased by the RF source as taught by Usai in the apparatus of Moslehi et al to generate both inductive and capacitive plasma and thus obtain uniform and high density plasma across the wafer surface.

Moslehi et al in view of Usai teach a slotted shield between peripheral ionization source and plasma but do not teach that the shield is a faraday shield. Use of faraday shield is known in the art to facilitate coupling of inductive energy and to limit the coupling of capacitive coupling of energy as per reference cited below.

Khater et al teach a plasma apparatus (Figure 1) comprising a plasma chamber with an inductive source coil 130 and a faraday shield 150 that controls coupling of capacitive energy during ignition and maintenance of plasma (column 5, line 54 to column 6, line 45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a faraday shield with slots as taught by Khater et al in the apparatus of Moslehi et al in view of Usai to control coupling of capacitive energy during ignition and maintenance of plasma (Abstract).

Regarding Claim 26: Moslehi et al in view of Usai and Khater et al teach all limitations of the claim (as already explained above under claim 1) including that substrate support 140 and coil segment 116 have a common fixed plane (due to up/down movement of substrate support 140 and the coil segment 116 the substrate support and the peripheral ionization source can be fixed in a common plane) {column 7, lines 1-60}.

Claims 1, 3, 8 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066).

Regarding Claims 1, 3, 8: Tanaka et al teach an inductive plasma apparatus (Figures 1, 3) that includes an RF source 22 and a plasma chamber 1 with pedestal 6 that has a substrate support portion 7 on which a substrate 8 is supported. Tanaka et al further teach that the apparatus further includes an annular coil (peripheral ionization source) 20 for generating plasma in the chamber that surrounds and is mounted on the periphery of the substrate support 6. Tanaka et al also teach that coil 20 is movable in up/down direction with the help of piston cylinder assembly 30 (to obtain optimum plasma field pattern) over a range from below the plane of substrate support to a plane above that of the substrate support 6 (that is, the peripheral ionization source surrounds the substrate support on the periphery of the substrate support, and the substrate support and the peripheral ionization source can form a common planar surface having a substrate support surface at its center (column 3, line 15 to column 4, line 50).

Tanaka et al teach an RF circuit that includes coil 20 (peripheral ionization source) but do not teach that the circuit is a series circuit and also includes substrate support that is biased by RF source and the peripheral ionization source is connected to substrate support. Further, Tanaka et al also do not teach a slotted faraday shield between the inductive element and plasma.

Usai teaches a plasma apparatus (Figures 1-4) that comprises an RF generator 6,

a series RF circuit that includes a substrate support electrode 3 and an inductive plasma coil (peripheral ionization source) 2, {that is, peripheral ionization source and the substrate support are connected together) a matching circuit 5 coupled to the series circuit such that both capacitive and inductive plasma are generated within the vacuum chamber. Usai also teaches that the apparatus generates a stable high density plasma (Column 3, line 30 to Column 4, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use an RF series circuit that also includes the substrate support which is biased by the RF source as taught by Usai in the apparatus of Tanaka et al to generate both inductive and capacitive plasma and thus obtain uniform and high density plasma across the wafer surface.

Tanaka et al in view of Usai do not teach a slotted shield between peripheral ionization source and plasma. Use of faraday shield is known in the art to facilitate coupling of inductive energy and to limit the coupling of capacitive coupling of energy as per reference cited below.

Khater et al teach a plasma apparatus (Figure 1) comprising a plasma chamber with an inductive source coil 130 and a faraday shield 150 with slots 152 that controls coupling of capacitive energy during ignition and maintenance of plasma (column 5, line 54 to column 6, line 45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a faraday shield with slots as taught by Khater et al in the apparatus of Tanaka et al in view of Usai to control coupling of capacitive energy during ignition and maintenance of plasma (Abstract).

Regarding Claim 26: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim (as already explained above under claim 1) including that substrate support 140 and coil segment 116 have a common fixed plane (due to up/down movement of coil 20, the substrate support and the peripheral ionization source can be fixed in a common plane) {column 4, lines 10-45}.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Roderick (US Patent No. 6,353,206).

Regarding Claim 4: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim including that peripheral ionization source includes an antenna that surrounds the substrate support and is coupled in series with substrate support.

Tanaka et al in view of Usai and Khater et al do not teach that antenna is capacitively coupled in the RF series circuit.

Roderick teach an apparatus (Figures 4C, 4D) wherein an antenna 40 surrounds the substrate holder 30 and is capacitively coupled (through capacitor C1) in a series circuit to a RF source 31 and through another capacitor C2 to the ground to control resonance frequency and also to minimize arcing between high voltage end of antenna and ground (column 4, line 10 to column 5, line 45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to capacitively couple the antenna with substrate support in the series circuit as taught by Roderick in the apparatus of Tanaka et al in view of Usai and Khater et al to eliminate arcing between high voltage end of antenna and ground.

Claims 5, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usui (US Patent No. 5,513,765) in view of Tanaka et al (US Patent No. 6,210,539) as applied to claim 1 and further in view of Moslehi et al (US patent No. 6,471,830).

Regarding Claim 5: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim including that matching network 5 is connected to an output of RF generator 6.

Tanaka et al in view of Usai and Khater et al do not teach the peripheral ionization source is capacitively connected at one end thereof to the matching network and is capacitively-coupled at an opposite end thereof to the substrate support surface.

Moslehi et al teach an inductive plasma apparatus (Figures 4, 6) for a semiconductor wafer processing comprising an RF generator 126, a matching network 128, a substrate support (chuck) 140 and an ionization source (coil segment) 116 that couples to the substrate support [Column 6, line 65 to column 10, line 8]. Moslehi et al also teach that matching network 128 (Moslehi et al – Figures 8A, 8B) is connected to an output of RF generator 126 and the peripheral ionization source (Coil) 116 is capacitively

connected at one end thereof to the matching network (through capacitor 160) and is capacitively-coupled to the substrate support surface 140 (Moslehi – Column 9, line 55 to Column 10, line 65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source connected capacitively to matching network and the substrate support as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai and Khater et al to provide control of coupling of RF power into the coil (column 8, lines 10-65).

Regarding Claim 9: Moslehi et al teach that the peripheral ionization source (coil) 116 is capacitively-coupled to the substrate support surface 140. Further, the matching network 128 has impedances (variable capacitors) 160 in series with the peripheral ionization source (coil) 116 that are appropriately tuned to the frequency of the RF generator 126 (Column 10,lines 45-65).

Regarding Claim 10: Moslehi et al teach that coil 116 is configured to inductively couple RF energy into plasma and it forms a high density plasma that can be configured as required by adjustable height of the coil 116 with respect to substrate 138 and by using desired shape of the coil (Column 7, lines 15-50 and Column 10, lines 1-7).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Moslehi et al (US Patent No. 6,471, 830) and Denda et al (US Patent No. 6,440,260).

Regarding Claim 6: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that antenna 116 is capacitively coupled to substrate support surface and is capacitively coupled to chamber ground, and that matching network is capacitively coupled to substrate support surface.

Moslehi et al teach (Figure 8A) that coil 116 is capacitively coupled to substrate support 140 and is capacitively coupled to chamber ground through capacitor 162 (Figure 8A – Moslehi et al).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to couple the antenna capacitively to substrate support surface as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai and Khater et al to enable proper matching of grounding and coupling capacitance and minimize RF potential on the antenna.

Tanaka et al in view of Usai, Khater et al and Moslehi et al do not teach matching network is capacitively coupled to substrate support surface.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 through blocking capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling (using a blocking capacitor) as taught by Denda et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Moslehi et al to smooth the power applied to the substrate support.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Dible et al (US Patent No. 6,042,686).

Regarding Claim 7: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that the substrate support is an electrostatic chuck.

Dible et al teach an apparatus (Figure 1(a) that includes a substrate support 2 with electrostatic clamping system and connected to RF power source 16 through a capacitor Cd (Column 4, line 45 to Column 5, line 30).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use an electrostatic chuck to support the substrate support as taught by Dible et al in the

apparatus of Tanaka et al in view of Usai and Khater et al to enable proper wafer clamping and uniform processing from center to edge of wafer (Column 5, lines 5-12).

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Denda et al (US Patent No. 6,440,260) and Liu et al (US PG Pub. No. 2002/0027205).

Regarding Claim 11: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim as explained above except that matching network is capacitively coupled to substrate support and the matching network has an input end and an output end and that it comprises of inductor and that the matching network includes an inductor connected in series with the (coil) ionization source.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that the matching network includes an inductor connected in series and further connected to the (coil) ionization source in series.

Liu et al teach an apparatus (Figure 7) that includes a matching network 50 that has an inductor 125 connected in series between input and output ends of the matching network and the inductor 125 is connected in series with antenna (coils) 46 [Paragraph 0014].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use matching network with inductor connected in series and also connected to ionization

source in series as taught by Liu et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to minimize reflective power and provide proper coupling current to the coil.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Denda et al (US Patent No. 6,440,260 and Pu et al (US Patent No. 6,825,618).

Regarding Claim 12: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except the matching network is capacitively-coupled to the substrate support surface, the matching network has an input and an output and includes an inductor connected in series between the input and output, and the peripheral ionization source is connected in parallel with the inductor of the matching network.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that the matching network includes an inductor connected in series and the (coil) ionization source is connected in parallel with the inductor of the matching circuit.

Pu et al teach an apparatus (Figure 8) that includes a matching network 31 that has an inductor 93 connected in series between input and output ends and also includes coils 40, 42 (peripheral ionization source) connected in parallel with the inductor 93 [Column 12, lines 25-45].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use matching network with inductor that is connected to ionization source in parallel as taught by Pu et al in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to minimize capacitive coupling between coil (ionization source) and plasma (column 12, lines 47-55).

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Denda et al (US Patent No. 6,440,260) and Hanawa (US Patent No. 6.027,601).

Regarding Claim 13: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that matching network is capacitively coupled to substrate support surface and that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et al do not teach that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor.

Hanawa teach an inductive plasma apparatus (Figures 1, 4) that includes a coil antenna 24 that provides matching between RF source 26 and the chamber (column 2, line 65 to column 3, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source instead of separate inductor for matching as taught by

Hanawa in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et al to exploit the antenna itself for matching and avoid the matching circuit elements.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al (US Patent No. 6,210,539) in view of Usui (US patent No. 5,513,765) and Khater et al (US Patent No. 6,459,066) as applied to claim 1 and further in view of Denda et al (US Patent No. 6,440,260), Hanawa (US Patent No. 6.027,601) and Moslehi et al (US Patent No. 6,471,830).

Regarding Claim 14: Tanaka et al in view of Usai and Khater et al teach all limitations of the claim except that matching network is capacitively coupled to substrate support surface and that peripheral ionization source (coil) is connected in series in the matching circuit in lieu of a separate inductor and peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Denda et al teach an apparatus (Figure 1) that includes a reaction chamber 18 with substrate support 22 connected to RF power source 28 via a matching network 30 capacitively coupled to substrate support through capacitor 32 (Column 4, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to connect matching network to substrate support by capacitive coupling as taught by Denda et al in the apparatus of Tanaka et al in view of Usai and Khater et al to smooth the power applied to the substrate support.

Tanaka et al in view of Usai, Khater et al and Denda et do not teach that peripheral ionization source (coil) is connected in the matching circuit in lieu of a separate inductor and that peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Hanawa teach an inductive plasma apparatus (Figures 1, 4) that includes a coil antenna 24 that provides matching between RF source 26 and the chamber (column 2, line 65 to column 3, line 15).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a peripheral ionization source instead of separate inductor for matching as taught by Hanawa in the apparatus of Tanaka et al in view of Usai, Khater et al and Denda et to exploit the antenna itself for matching and avoid the matching circuit elements.

Tanaka et al in view of Usai, Khater et al, Denda et al and Hanawa do not teach that peripheral ionization source includes individual inductive elements connected in series through stray mutual capacitance.

Moslehi et al teach an inductive plasma apparatus (Figures 4, 6) for a semiconductor wafer processing comprising an RF generator 126, a matching network 128, a substrate support (chuck) 140 and an ionization source (coil segment) 116 that couples to the substrate support. Moslehi et al also teach that peripheral ionization source (coil) 116 includes individual inductive elements (coils) that are connected in series through capacitors (to balance mutual stray capacitance) since all the inductive elements of the coil are grounded (Moslehi et al - Figures 8A, 8B and Column 11, lines 1-10 and Usui- Figure 1).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a shield with slots as taught by Moslehi et al in the apparatus of Tanaka et al in view of Usai, Khater et al, Denda et al and Hanawa to minimize proper matching of grounding capacitance and coupling capacitors and RF potential on the antenna (column 11, lines 1-10).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Rakesh Dhingra

P.H.
Parviz Hassanzadeh
Supervisory Patent Examiner
Art Unit 1763